CLAIMS

1. A method of controlling the relative position of a plurality of optical exposures of a photosensitive material, comprising:

making an exposure of the photosensitive material by illuminating it with a pattern of light to create therein a corresponding latent exposure pattern;

imaging the exposed photosensitive material to reveal and determine the position of the latent exposure pattern; and

controlling the position of at least one further exposure of the photosensitive material based on the determined position of the latent exposure pattern.

2. A method according to claim 1 wherein the exposed photosensitive material is imaged at a different wavelength from said first-mentioned or further exposures.

3. A method according to claim 1 or 2 wherein the photosensitive material comprises an indicative material sensitive to the local extent of the exposure and which in said imaging step reveals exposed areas of the photosensitive material.

4. A method according to claim 3 wherein said indicative material is sensitive to exposure-induced chemical changes in the photosensitive material.

5. A method according to claim 3 or 4 wherein said indicative material comprises a fluorescent or luminescent substance.

6. A method according to any one of the preceding claims wherein said pattern of light is a pattern which regularly repeats in two or three dimensions.

7. A method according to claim 6 wherein said pattern of light is such as to define in the photosensitive material regions of the photosensitive material for forming a photonic crystal lattice.

8. A method according to claim 6 or 7 wherein said pattern of light is an interference pattern formed by the intersection of plural light beams in the photosensitive material.

9. A method according to claim 7 or 8 wherein the further exposure is such as to define a modification to the photonic crystal lattice.

10. A method according to claim 9 wherein said modification is a discontinuity for defining a structure operable as waveguide or resonator.

11. A method according to any one of the preceding claims wherein the at least one further exposure is made by multiple-photon absorption in the photosensitive material.

12. A method according to any one of the preceding claims wherein the further exposure is by a writing light beam illuminating a selectable position in the photosensitive material defined with respect to the imaged latent exposure pattern.

13. A method according to claim 12 wherein the writing light beam is formed by a confocal microscope.

14. A method according to any one of the preceding claims wherein the imaging is by a confocal microscope or scanning focussed laser beam.

15. A method according to any one of the preceding claims wherein the step of imaging forms a three dimensional image of the latent exposure pattern in the photosensitive material.

16. A method according to any one of the preceding claims wherein the photosensitive material comprises a photo-acid generator and each exposure causes

the dissociation of the photo-acid generator, to form acid that acts as a latent catalyst for subsequent chemical development processes.

17. A method according to claim 16 in which the local acid concentration is determined in the imaging step by changes in the optical absorption or emission characteristics of an acid-sensitive dye included in the photosensitive material.

18. A method according to claim 16 or 17 in which the wavelength of said at least one further exposure is chosen so as to cause the dissociation of a photobase generator included in the photosensitive material that locally neutralizes the photoacid generated in earlier exposures.

19. A method according to any one of the preceding claims wherein the photosensitive material is a cross-linkable epoxy resin precursor.

20. A method according to any one of the preceding claims comprising alternately repeating said imaging and further exposure steps to build-up a desired latent exposure pattern.

21. A method of forming a structure in a photosensitive material by performing a plurality of exposures of the material controlled according to the method of any one of the preceding claims and developing the photosensitive material after said further exposure to remove regions of photosensitive material selectively on the basis of their exposure level.

22. A method according to claim 21 wherein the developing step comprises at least one of chemical and thermal treatment.

23. A method of forming an optical element by using a structure formed in accordance with the method of claim 21 or 22 as a template to define the optical

element in a material of selected optical properties.

24. A method of forming an optical element by forming a structure in accordance with the method of claim 21 or 22 in a material having selected optical properties.